

IN THE CLAIMS:

1 1. (Currently Amended) A storage server system having a processor and a memory , the
2 storage server system comprising:

3 (A) a storage operating system adapted to be executed by the processor;

4 (B) a removable nonvolatile memory device coupled to a system bus, the re-
5 movable nonvolatile memory device divided into a plurality of partitions including a first
6 partition containing diagnostics code for the system and a second partition designated as
7 a maintenance log into which test results and data are stored; and

8 (C) a set of boot instructions resident in the storage server system including
9 instructions for executing a normal boot routine upon a power-on of the system, and in-
10 cluding instructions enabling the processor to identify the removable nonvolatile memory
11 device and to load the diagnostics code into the memory in response to a command to
12 execute a diagnostics boot routine instead of the normal boot routine, the command gen-
13 erated by the storage system upon a failure of the normal boot routine.

1 2. (Cancelled)

1 3. (Cancelled)

1 4. (Currently Amended) The system as defined in claim 2-1 further comprising:

2 (A) an input/output device coupled to the system bus, and which input/output
3 device is identifiable by the processor; and

4 (B) a second bus coupled between the input/output device and the compact
5 flash in such a manner that when the processor identifies the input/output device, the

6 compact flash is, in turn, initialized and the diagnostics code is executed upon a com-
7 mand to run a diagnostics boot routine.

1 5. (Original) The system of claim 1 further comprising:

2 (A) a storage adapter coupled to the system bus; and
3 at least one storage disk coupled to the storage adapter and containing files served by the
4 operating system.

1 6. (Currently Amended) A server system having a processor and a memory, the server
2 system comprising:

3 (A) a storage operating system adapted to be executed by the processor;

4 (B) a removable nonvolatile memory device coupled to a system bus, the re-
5 movable nonvolatile memory device divided into a plurality of partitions including a first
6 partition containing diagnostics code for the system and a second partition designated as
7 a maintenance log into which test results and data are stored by execution of the diagnos-
8 tic code;

9 (C) a set of boot instructions resident in the server system including instruc-
10 tions for executing a normal boot routine upon a power-on of the system, and including
11 instructions enabling the processor to identify the removable nonvolatile memory device
12 and to load the diagnostics code into the memory in response to a command to execute a
13 diagnostics boot routine instead of the normal boot routine, the command generated by
14 the storage system upon a failure of the normal boot routine;

15 (D) a storage adapter coupled to the system bus;

16 (E) at least one storage disk coupled to the storage adapter and containing files
17 served by the operating system; and

18 (F) a plurality of storage disks coupled to the storage adapter and data on the
19 disks being stored in a write anywhere file layout system.

1 7. (Original) The system as defined in claim 1 further comprising a motherboard upon
2 which the processor, the memory and the set of boot instructions reside.

1 8. (Original) The system as defined in claim 7 wherein the removable nonvolatile
2 memory device containing the diagnostics code is resident external to the motherboard,
3 and the diagnostics code on the removable nonvolatile memory device is adapted to be
4 upgraded or amended free of taking the system out of service.

1 9. (Previously Presented) The system as defined in claim 1 wherein said diagnostic
2 code includes code relating to the diagnostics of hardware devices including the proces-
3 sor, the memory, the buses, the adapters, the disks, a compact flash and interfaces
4 thereof.

1 10. (Original) The system as defined in claim 1 wherein said boot instructions reside in
2 firmware.

1 11. (Previously Presented) A method of performing diagnostics in a storage server sys-
2 tem, the storage server system having a processor and a memory, the method comprising
3 the steps of:

4 (A) providing a removable nonvolatile memory device interfaced with a mother-
5 board, the removable nonvolatile memory device being identifiable to the processor;

6 (B) dividing the removable nonvolatile memory device into separate memory par-
7 titions;

8 (C) storing a set of diagnostics instructions, being a diagnostics code, in one of the
9 partitions of the removable nonvolatile memory device; and

10 (D) programming a system firmware to recognize a user implemented command
11 entered through a command line interface, the command entered during the normal boot
12 routine for a diagnostics boot such that in response to the diagnostics boot command, the
13 firmware loads the diagnostics code residing in the removable nonvolatile memory de-
14 vice into the memory to execute a diagnostic boot routine instead of a normal boot rou-
15 tine.

1 12. (Original) The method as defined in claim 11 including the further step of

2 (E) maintaining, in a separate partition of the removable nonvolatile memory
3 device, a maintenance log into which diagnostic test results data and data about the stor-
4 age system are stored.

1 13. (Original) The method as defined in claim 11 including the further step of:

2 selecting as the removable nonvolatile memory device, a compact flash.

1 14. (Original) The method as defined in claims 11 including the further step of:

2 selecting as the removable nonvolatile memory device a personal computer (PC)
3 card.

1 15. (Original) The method as defined in claim 11 including the further step of:

2 upgrading the diagnostics code without taking the file server out of service.

1 16. (Currently Amended) A storage system having a processor and a memory, the stor-
2 age system comprising:

3 (A) means for storing a set of diagnostics instructions comprising diagnostics
4 code, in a removable nonvolatile memory device coupled to a system bus, the removable
5 nonvolatile memory device divided into a plurality of partitions including a first partition
6 containing diagnostics code for the system and a second partition designated as a mainte-
7 nance log into which test results and data are stored~~being identifiable to the system by~~
8 execution of the diagnostic code; and

9 (B) means for executing the diagnostics code in response to a diagnostics boot
10 command received by system firmware, the command generated by the storage system
11 upon a failure of the normal boot routine.

1 17. (Original) The storage system of claim 16 further comprising:

2 means for coupling the removable nonvolatile memory device to the processor in
3 such a manner that the diagnostics code may be upgraded without taking the storage sys-
4 tem out of normal service.

1 18. (Original) The storage system of claim 17, further comprising:

2 means for upgrading the diagnostics code by interfacing with the storage system
3 through an associated input/output interface.

1 19. (Currently Amended) A computer-readable medium operating on a computer in a
2 network that includes one or more storage systems sharing volumes, the computer-
3 readable medium including program instructions for performing the steps of:

- 4 (A) initiating a power-on self test when the computer is powered-on;
- 5 (B) identifying devices present in the computer;
- 6 (C) in response to a successful power-on self test, commencing a normal boot
7 routine;
- 8 (D) recognizing a command for a diagnostics boot, the command generated by
9 the storage system upon a failure of the normal boot routine;
- 10 (E) in response to the diagnostics boot command, probing devices to locate a
11 removable nonvolatile memory device containing diagnostic boot instructions; ~~and~~
- 12 (F) interrupting the normal boot routine and executing the diagnostics code for
13 a diagnostics boot for the computer; and
- 14 (G) identifying a compact flash as the removable nonvolatile memory device,
15 the compact flash divided into a plurality of partitions including a first partition contain-
16 ing diagnostics code for the system and a second partition designated as a maintenance
17 log into which test results and data are stored by execution of the diagnostic code.

20. (Cancelled)

1 21. (Cancelled)

1 22. (Currently Amended) The computer readable medium as defined in claim ~~21~~19
2 wherein the diagnostics boot command is initiated by a human maintenance operator.

1 23. (Currently Amended) The computer readable medium as defined in claim ~~21~~19
2 wherein the diagnostics boot command is initiated as an instruction in the computer read-
3 able medium upon the occurrence of a predetermined event.

1 24. (Currently Amended) A diagnostic system for use with a storage system comprising:
2 a removable nonvolatile memory device interconnected with the storage system,
3 wherein the removable nonvolatile memory device containing boot diagnostic code that
4 is loadable into the storage system as an alternative to a normal boot routine when the
5 storage system generates a command to boot diagnostic code upon a failure of the normal
6 boot routine;

7 wherein the removable nonvolatile memory device includes a plurality of parti-
8 tions including a first partition wherein the boot diagnostic code is contained and a sec-
9 ond partition storing a diagnostic log for storage of diagnostic data by execution of the
10 diagnostic code.

1 25. (Cancelled)

1 26. (Cancelled)

1 27. (Cancelled)

1 28. (Original) The diagnostic system of claim 24, wherein the removable nonvolatile
2 memory device is a PC card.

1 29. (Original) The diagnostic system of claim 24, wherein the removable nonvolatile
2 memory device is a compact flash.

1 30. (Original) The diagnostic system of claim 24, wherein the storage system further
2 comprises a firmware boot routine, the firmware boot routine having a process for select-
3 ing between execution of either a normal boot routing or a diagnostic boot routine.

1 31. (Previously Presented) A server system having a processor and a memory, the server
2 system comprising:

3 (A) a storage operating system adapted to be executed by the processor;

4 (B) a removable nonvolatile memory device coupled to a system bus, the re-
5 movable nonvolatile memory device containing diagnostics code for the system, the re-
6 movable nonvolatile memory device also divided into a plurality of partitions with the
7 diagnostics code residing in at least one of the partitions; and

8 (C) a set of boot instructions resident in the server system including instruc-
9 tions for executing a normal boot routine upon a power-on of the system, and including
10 instructions enabling the processor to identify the removable nonvolatile memory device
11 and to load the diagnostics code into the memory in response to a command to execute a
12 diagnostics boot routine instead of the normal boot routine, the command generated by
13 the storage system upon a failure of the normal boot routine.

1 32. (Original) The system of claim 29 wherein one of the partitions is designated as a
2 maintenance log into which test results and data are stored.

1 33. (Original) The system of claim 29 further comprising:

2 a separate storage medium, the separate storage medium storing a boot routine.

1 34. (Previously Presented) The system of claim 33, wherein the separate storage medium
2 is a partition on the removable nonvolatile memory device.

1 35. (Currently Amended) A computer having a processor and a main memory, the com-
2 puter comprising:

3 a non-removable non-volatile memory device containing a boot mechanism firm-
4 ware, the boot mechanism firmware configured to provide a normal boot routine and se-
5 lect a first logical drive to boot from;

6 a command line interface configured to allow a user to enter a command to run a
7 diagnostic routine; and

8 a removable non-volatile memory device storing the diagnostic routine, ~~at least a~~
9 ~~portion~~ a partition of the removable non-volatile memory device configured as a second
10 logical drive, the boot mechanism firmware configured to, in response to the user's com-
11 mand, select the second logical drive to boot from and load the diagnostic routine into
12 main memory.

1 36. (Cancelled)

1 37. (Currently Amended) The computer of claim 35 further comprising:

2 an additional ~~portion~~ partition of the removable non-volatile memory configured
3 to store a maintenance log generated by the diagnostic routine.

1 38. (Previously Presented) A computer having a processor and a main memory, the
2 computer comprising:

3 a non-removable non-volatile memory device containing a boot mechanism firm-
4 ware, the boot mechanism firmware configured to provide a normal boot routine and se-
5 lect a first logical drive to boot from;

6 a user interface configured to allow a user to enter a command to run a diagnostic
7 routine;

8 a removable non-volatile memory device storing the diagnostic routine, at least a
9 portion of the removable non-volatile memory device configured as a second logical
10 drive, the boot mechanism firmware configured to, in response to the user's command,
11 select the second logical drive to boot from and load the diagnostic routine into main
12 memory; and

13 an additional portion of the removable non-volatile memory configured to store a
14 maintenance log generated by the diagnostic routine, wherein the additional portion of
15 the removable non-volatile memory is an additional memory partition that is configured
16 as a third logical drive.

1 39. (Previously Presented) The computer of claim 35 further comprising:

2 a file system for accessing logical drives, the file system configured to upgrade or
3 modify contents of the removable non-volatile memory while the computer is online by
4 accessing the removable non-volatile memory as a drive.

5

1 40. (Previously Presented) The computer of claim 35 wherein the removable non-
2 volatile memory device is a compact flash.

1 41. (Currently Amended) A method for performing diagnostics on a computer having a
2 processor and a main memory, the method comprising the steps of:

3 configuring a boot mechanism firmware to provide a normal boot routine;

4 providing a command line interface to allow a user to enter a command to inter-
5 rupt the normal boot routine and run a diagnostic routine, the diagnostic routine stored on
6 a removable non-volatile memory, at least a portion of the removable non-volatile mem-
7 ory device configured as a logical drive; and

8 selecting, in response to the user's command, the logical drive to boot from and
9 loading the diagnostic routine into main memory;

10 partitioning the removable non-volatile memory device into a plurality of mem-
11 ory partitions such that the at least a portion of the removable non-volatile memory de-
12 vice is a memory partition; and

13 configuring an additional portion of the removable non-volatile memory to store a
14 maintenance log generated by the diagnostic routine .

1 42. (Cancelled)

1 43. (Cancelled)

1 44. (Previously Presented) A method for performing diagnostics on a computer having a
2 processor and a main memory, the method comprising the steps of:

3 configuring a boot mechanism firmware to provide a normal boot routine;

4 providing a user interface to allow a user to enter a command to interrupt the
5 normal boot routine and run a diagnostic routine, the diagnostic routine stored on a re-
6 movable non-volatile memory, at least a portion of the removable non-volatile memory
7 device configured as a logical drive;

8 selecting, in response to the user's command, the logical drive to boot from and
9 loading the diagnostic routine into main memory;

10 configuring an additional portion of the removable non-volatile memory to store a
11 maintenance log generated by the diagnostic routine;

12 and

13 configuring the additional memory partition as a third logical drive.

1 45. (Previously Presented) The method of claim 41 further comprising the step of:
2 modifying the contents of the removable non-volatile memory while the computer
3 is online by accessing the removable non-volatile memory as a drive.

1 46. (Previously Presented) The method of claim 41 wherein the removable non-volatile
2 memory device is a compact flash.

1 47. (Currently Amended) A computer having a processor and a main memory, the com-
2 puter comprising:

3 a non-removable non-volatile memory device containing a boot mechanism firm-
4 ware, the boot mechanism firmware configured to provide a normal boot routine and se-
5 lect a first logical drive to boot from;

6 a command line interface configured to allow a user to enter a command to inter-
7 rupt the normal boot routine and run a diagnostic routine; ~~and~~

8 a removable non-volatile memory device storing the diagnostic routine, ~~at least a~~
9 ~~portion~~ a first partition of the removable non-volatile memory device configured as a sec-
10 ond logical drive, the boot mechanism firmware configured to, in response to the user's
11 command, select the second logical drive to boot from and load the diagnostic routine
12 into main memory; and

13 a second partition of the removable non-volatile memory device designated as a
14 maintenance log into which test results and data are stored by execution of the diagnostic
15 routine.

1 48. (Currently Amended) A computer having a processor and a main memory, the com-
2 puter comprising:

3 a boot mechanism firmware configured to provide a normal boot routine;

4 a removable non-volatile memory, at least a portion of the removable non-volatile
5 memory device configured as a first logical drive and configured to store a diagnostic
6 routine; ~~and~~

7 a command line interface configured to allow a user to enter a command to inter-
8 rupt the normal boot routine the user interface configured to, in response to the user's
9 command, select the logical drive to boot from and load the diagnostic routine into main
10 memory and

11 an additional portion of the removable non-volatile memory configured to store a
12 maintenance log generated by the diagnostic routine, wherein the additional portion of
13 the removable non-volatile memory is an additional memory partition that is configured
14 as a third logical drive.

1 49. (Currently Amended) A computer having a processor and a main memory, the com-
2 puter comprising:

3 means for providing a normal boot routine;

4 means for allowing a user to enter a command to interrupt the normal boot routine
5 and run a diagnostic routine, the diagnostic routine stored on a removable non-volatile
6 memory, at least a portion of the removable non-volatile memory device configured as a
7 logical drive; ~~and~~ an additional portion of the removable non-volatile memory configured
8 to store a maintenance log generated by the diagnostic routine, wherein the additional
9 portion of the removable non-volatile memory is an additional memory partition that is
10 configured as a third logical drive; and

11 means for selecting, in response to the user's command, the logical drive to boot
12 from and loading the diagnostic routine into main memory.

1 50. (Currently Amended) A computer readable medium containing executable program
2 instructions for performing diagnostics on a computer, the executable program instruc-
3 tions comprising program instructions for:

4 providing a normal boot routine;

5 providing a command line interface to allow a user to enter a command to inter-
6 rupt the normal boot routine and run a diagnostic routine, the diagnostic routine stored on
7 a removable non-volatile memory, at least a portion of the removable non-volatile mem-
8 ory device configured as a logical drive and an additional portion of the removable non-
9 volatile memory configured to store a maintenance log generated by the diagnostic rou-
10 tine, wherein the additional portion of the removable non-volatile memory is an addi-
11 tional memory partition that is configured as a third logical drive; and

12 selecting, in response to the user's command, the logical drive to boot from and
13 loading the diagnostic routine into main memory.

1 51. (Previously Presented) The system of claim 1 further comprising:

2 (D) the set of boot instructions configured to boot the system from a logical drive
3 associated with the removable nonvolatile memory device.

1 52. (Previously Presented) A computer having a processor and a main memory, the
2 computer comprising:
3 a non-removable non-volatile memory device containing a boot mechanism firm-
4 ware, the boot mechanism firmware configured to provide a normal boot routine;
5 a removable non-volatile memory device partitioned into a first and a second
6 logical drive, the first logical drive storing the diagnostic routine, the boot mechanism
7 firmware configured to select the first logical drive to boot from and load the diagnostic
8 routine into main memory; and
9 the second logical drive configured to store a maintenance log generated by the
10 diagnostic routine.

1 53. (Previously Presented) The computer of claim 52, wherein the boot mechanism firm-
2 ware is configured to select the first logical drive upon a command generated by the
3 computer upon a failure of the normal boot routine.

1 54. (Previously Presented) A method for performing diagnostics on a computer having a
2 processor and a main memory, comprising:
3 configuring a boot mechanism firmware to provide a normal boot routine;
4 providing a removable non-volatile memory device partitioned into a first and a
5 second logical drive, the first logical drive storing the diagnostic routine, the boot mecha-
6 nism firmware configured to select the first logical drive to boot from and load the diag-
7 nostic routine into main memory; and

8 storing a maintenance log generated by the diagnostic routine in the second logi-
9 cal drive.

1 55. (Previously Presented) The method of claim 54, further comprising:

2 selecting, by the boot mechanism firmware, the first logical drive upon a com-
3 mand generated by the computer upon a failure of the normal boot routine.

1 56. (Previously Presented) An apparatus to perform diagnostics on a computer having a
2 processor and a main memory, comprising:

3 means for configuring a boot mechanism firmware to provide a normal boot rou-
4 tine;

5 means for providing a removable non-volatile memory device partitioned into a
6 first and a second logical drive, the first logical drive storing the diagnostic routine, the
7 boot mechanism firmware configured to select the first logical drive to boot from and
8 load the diagnostic routine into main memory; and

9 means for storing a maintenance log generated by the diagnostic routine in the
10 second logical drive.

1 57. (Previously Presented) The apparatus of claim 56, further comprising:

2 means for selecting, by the boot mechanism firmware, the first logical drive upon
3 a command generated by the computer upon a failure of the normal boot routine.

1 58. (Previously Presented) A computer readable medium containing executable program
2 instructions for performing diagnostics on a computer having a processor and a main
3 memory, comprising:
4 configuring a boot mechanism firmware to provide a normal boot routine;
5 providing a removable non-volatile memory device partitioned into a first and a
6 second logical drive, the first logical drive storing the diagnostic routine, the boot mecha-
7 nism firmware configured to select the first logical drive to boot from and load the diag-
8 nostic routine into main memory; and
9 storing a maintenance log generated by the diagnostic routine in the sec-
10 ond logical drive.